

DESCRIPTION OF A NEW SPECIES OF EXTINCT HORSE,
EQUUS LAMBEI, FROM THE PLEISTOCENE OF YUKON
TERRITORY.

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The writer has the privilege of describing what appears to be a new species of fossil horse from the Klondike region, Yukon Territory. The fine skull which forms the type of this species was found on April 10, 1903, by Mr. John M. Morrison, now of Anacortes, Washington, while mining for gold on Gold Run Creek. This is about 30 miles southeast of Dawson. He unearthed the skull himself on claim No. 34, at a depth of 32 feet below the surface. Mr. Morrison states that starting from the surface there was from 18 to 20 feet of muck; below this about 12 feet of fine gravel; and beneath this from 4 to 6 feet of coarse gravel, which carries gold. Immediately below this coarse gravel is the bedrock, and on this lay the skull. Mr. Morrison writes that in the eye sockets was "pay dirt" from which he panned gold. The deposit in which the skull was buried was frozen and may have been in this condition for thousands of years. To this new species is given the name *Equus lambei*, in honor of Mr. Lawrence M. Lambe, vertebrate palaeontologist of the Geological Survey of Canada.

Type-specimen.—Cat. No. 8226 U.S.N.M.

Type-locality.—Gold Run Creek, Klondike region, Yukon Territory.

Type-formation.—Pleistocene.

Diagnosis.—Belongs among the smaller and broad-skulled horses. Teeth unusually broad; their enamel little plicated; the protocones unusually long.

The skull is practically complete (pls. 56-58). What is unusual is that the skull and the lower jaw were together. The left third upper incisor and the left first lower incisor have been lost since exhumation. The extreme tips of the nasals are broken off, most of the vomer and the turbinal bones are gone, and a little bone here and there is missing. The skull is of the color of cream. Almost without other exception, bones from Alaska and Yukon are stained brown. The skull was that of a mare. Its age is believed to have been 12 years or more.

The following measurements have been obtained from the skull:

Measurements of the skull.

From middle of incisive border to front of foramen magnum (basilar length)-----	446
From middle of incisive border to front of posterior nares-----	245
From middle of incisive border to naso-premaxillary notch-----	167
From middle of incisive border to middle of occipital crest (vertex length)-----	498
From middle of incisive border to front of pm ² , direct-----	120
From middle of incisive border to front of orbit-----	392
From middle of incisive border to middle of line joining hinder borders of orbits (facial length)-----	343
From middle of incisive border to rear of orbit direct-----	357
From rear of orbit to middle of occipital crest-----	188
From occipital crest to middle of line joining rears of orbits (cranial length)-----	160
From rear of hard palate to notch in vomer-----	93
From notch in vomer to front of foramen magnum-----	116
Width across mastoid processes-----	102
Width across glenoid fossae-----	187
Width from outside to outside of parastyles of last molars-----	120
Width from outside to outside of last premolars-----	118
Width from outside to outside of outer incisors-----	72
Width of the face at the front of the orbits-----	152
Width at the rear of the orbits (frontal width)-----	198
Width on the maxillary ridges at maxillo-malar suture-----	171
Width of palate at last molars-----	65
Width of palate at pm ² , least-----	47
Width of palate at diastema, least-----	43
Length of orbit-----	54
From front of symphysis of lower jaw to rear of ascending ramus-----	385
Length of symphysis-----	80
Height of jaw of front of m ₁ -----	81
From front of symphysis to front of pm ₂ -----	108

In 1915¹ the writer presented a table which gave various measurements and indices derived from the measurements of the skulls of 16 individuals of *Equus caballus*. The measurements were taken from a table prepared by Nehring.² Eight of these skulls were those of small horses, and the basilar lengths ranged from 426 mm. to 452 mm. In the other eight the basilar length varied from 536 mm. to 585 mm. By consulting the writer's table or that of Nehring it will be found that the short skulls are relatively broader than the larger ones, the cephalic index (= frontal width \times 100 \div basilar length) varying from 42 to 45.9. The average is 44.2. In the long-headed horses the cephalic index varies from 38.9 to 43.6, the averages in the eight horses being 41.1. In the Yukon skull here described the cephalic index is 44.4, which shows that the species belonged among the small horses having broad skulls.

¹ Proc. U. S. Nat. Mus., vol. 48, p. 559.

² Landwirthsch. Jahrb., vol. 13, 1884, p. 81.

In Nehring's eight small horses the cranio-cephalic index (= cranial length \times 100 \div basilar length) averaged 36; in the eight large horses it averaged only 33. In the Yukon skull it is 35.7.

In the eight small horses of the tables referred to the facio-cephalic index (facial length \times 100 \div basilar length) average 76.1; in the large horses, 74.1. In *E. lambei* it is 76.9.

It is seen therefore that as compared with the races of *Equus caballus* the Yukon species, *E. lambei* ranges itself with the small horse having short and broad heads, but with a high facio-cephalic index.

It will be well to compare certain indices of the species here described with those of four other forms.

Table of indices.¹

Species (types.)	Cephalic index.	Facio-cephalic index.	Cranio-cephalic index.	Index of tooth line.
<i>Equus niobrarensis</i>	45.2	75.3	34.3	33.7
<i>E. niob. alaskae</i>	44.2	73	35	34.1
<i>E. hatcheri</i>	42.8	74.8	35.3	33.9
<i>E. laurentius</i>	43	75	33.3
<i>E. lambei</i>	44.4	76.9	35.9	37.4

It will be observed that the Yukon horse stands above the others of the table in the facio-cephalic and the cranio-cephalic indices and the index of the tooth line.

It is found that the brain case of the Yukon horse exceeds in size that of two skulls of the domestic horse at hand. In one of these, No. 843 of the United States National Museum, the width of the brain case is 21.1 per cent of the basilar length; the height above the lower surface of the cranial axis, 19.1 per cent. In the other, an old horse, No. 5044, the percentages are respectively 20.6 and 19.3. In the Yukon horse the percentages are both 23.1.

The lower jaw (pl. 56, fig. 1) differs greatly from that of an old domestic horse at hand. In the latter the angle of the jaw is very broad, and the width at the last premolar is only a little more than half that at the angle. In the Yukon horse the greatest width is 112 mm.; that at the last premolar, 84 mm.; just .75 of the width at the angle. This angle is very broad in *E. laurentius*.² The lower jaw of *E. niobrarensis*³ and that of *E. hatcheri*⁴ resemble considerably that of the species here described.

¹ These indices are taken partly from a table on page 590 of volume 44 of the Proceedings of the U. S. National Museum. Through an error the abbreviation *mm.* is found at the head of each of the columns of that table.

² Proc. U. S. Nat. Mus., vol. 44, 1913, p. 72.

³ Idem, pl. 70.

⁴ Proc. U. S. Nat. Mus., vol. 48, 1915, pl. 32.

Some minor features of the skull need to be mentioned. The inter-orbital region is flat, even a little concave. From the middle of the brain case the outline descends rather strongly to the occipital crest. The infraorbital foramen is situated unusually high. The space between the orbit and the foramen just named is swollen, being convex, not concave as it is in the domestic horse. The maxillary ridge is less prominent than in the domestic horse. The condylar foramen is in wide communication with the foramen lacerum posterius. The palate is more strongly vaulted than that of the domestic horse.

The teeth are in fine condition. They are, however, considerably worn, and to this perhaps is due to some extent, but not entirely, their unusual breadth and the great simplicity of the enamel. The premolars and molars appear to be worn down to about one-half of their original length. The last premolar has a height of 40 mm. The lower incisors are worn so that the cups have disappeared, but these are still present in all of the upper incisors. The following are the measurements:

Measurements of the upper teeth.

	<i>mm.</i>
Length of premolar-molar series.....	167
Length of premolar series.....	87
Length of molar series.....	77
Pm ² , length.....	36
width.....	28
protocone.....	12
Pm ³ , length.....	25.5
width.....	28
protocone.....	17
Pm ⁴ , length.....	26
width.....	29
protocone.....	17
M ¹ , length.....	22.5
width.....	27
protocone.....	14
M ² , length.....	24.4
width.....	27
protocone.....	16
M ³ , length.....	27
width.....	24.5
protocone.....	19

Measurements of the lower teeth.

Length of premolar series.....	83
Length of molar series.....	80
Pm ₂ , length.....	31
width.....	17.5
Pm ₃ , length.....	26.5
width.....	19
Pm ₄ , length.....	26.5
width.....	18.8
M ₁ , length.....	22.5
width.....	16.5
M ₂ , length.....	26
width.....	16.5
M ₃ , length.....	32
width.....	16

The measurements of these teeth may be compared with those of *Equus hatcheri*, *E. niobrarensis*, *E. caballus*,¹ *E. francisci*,² *E. laurentius*³ *E. complicatus*, *E. scotti*, *E. niobrarensis*, *E. laurentius*,⁴ *E. niobrarensis alaskae*.⁵

The teeth are remarkable on account of their relatively large size and on account of the great breadth of the grinding surface as compared with its length. As shown in the table on page 437, the whole upper tooth line is equal to 37.4 per cent of the basilar length, while in the other species there considered, and in *E. caballus*, it lies between 33 per cent and about 34 per cent. The following tables show, in various species, the widths of the premolars and molars as compared with the length taken as 100:

Table of indices of crowns of upper teeth of extinct horses.

Teeth.	<i>E. lambei.</i>	<i>E. laurentius.</i>	<i>E. hatcheri.</i>	<i>E. niobrarensis.</i>	<i>E. niob. alaskae.</i>	<i>E. scotti.</i>
Pm ²	77.7	70.0	70.0	71.1	67.9	73.8
Pm ³	109.8	94.2	101.6	93.3	93.3	94.3
Pm ⁴	111.5	100.0	100.0	93.1	100.0	100.0
M ¹	120.0	106.8	101.8	103.7	107.8	100.0
M ²	110.6	102.2	98.2	92.6	100.0	93.5
M ³	90.7	73.3	80.0	81.0	92.5	83.8

Table of indices of crowns of upper teeth of domestic horses.

Teeth.	No. 16274, A. M. N. H., 5 years.	No. 14131, A. M. N. H., 8 years.	No. 289, A. M. N. H., 15 years.	No. 16277, A. M. N. H., 20 years.	No. 843, U. S. N. M., 8 years.	No. 5044, U. S. N. M., 20 years.
Pm ²	67.5	69.9	59.7	66.7	71.1	66.6
Pm ³	89.1	96.2	93.2	101.9	93.3	105.5
Pm ⁴	91.7	96.4	98.2	108.0	93.1	103.7
M ¹	90.0	103.9	108.3	116.2	103.7	120.9
M ²	88.3	101.9	102.8	116.3	92.6	111.0
M ³	74.1	74.6	75.0	75.0	81.0	82.2

From the table showing the relation of the width of the crowns to their lengths in the extinct species it is seen that the teeth of the Yukon horse are much broader. It is known, however, that as the upper teeth are worn down the fore-and-aft length of the crown diminishes more rapidly than the width, with the result that the index rises. The Yukon horse is older than any of the other extinct species used in comparison. In the next table the upper teeth of the Yukon horse are compared with those of domestic horses of various ages. The indices of the horses in the American Museum of Natural

¹ Proc. U. S. Nat. Museum, vol. 48, 1915, p. 531.

² Idem, p. 539.

³ Idem, vol. 44, 1913, p. 584.

⁴ Iowa Geol Surv., vol. 23, pp. 160-208.

⁵ Smiths. Misc. Coll., vol. 61, No. 2, p. 1.

History are derived from measurements furnished by Gidley.¹ Not even in the horse supposed to be 20 years old are the teeth as broad relatively to the length as in the Yukon fossil. However, in a horse in the U. S. National Museum (No. 5044), the first and second molars exceed very slightly in relative breadth those of the Yukon horse; but that horse is evidently much older; or, at least, the teeth are much more worn. The cups are gone from the upper incisors and the last premolar is worn down to a height of only 26 mm.

When we come to compare the lower teeth with those of the several extinct species, with those of a large horse about 8 years old, and with the old horse just mentioned, it is found that none of them approach in width the teeth of the Yukon horse.

Table of indices of crowns of lower teeth of horses.

Teeth.	<i>E. lambet.</i>	<i>E. laurentius.</i>	<i>E. hatcheri.</i>	<i>E. niobrarensis.</i>	<i>E. scotti.</i>	<i>E. caballus</i> No. 174960.	<i>E. caballus</i> No. 5044.
Pm ₂	53.2	46.9	40.0	42.8	48.6	43.1	46.9
Pm ₃	71.7	58.9	60.0	57.1	53.0	60.0	60.4
Pm ₄	70.9	55.2	56.7	53.3	54.5	58.3	61.3
M ₁	75.6	60.0	62.1	50.9	57.6	55.7	60.9
M ₂	65.4	53.9	56.1	50.0	48.4	54.6	61.5
M ₃	48.4	46.7	42.8	43.3	44.1	40.6	42.2

The grinding faces of the upper teeth (pl. 57) present various peculiarities. The outer styles are only moderately developed. As compared with the domestic horse, the outer face of the paracone is shallow and flat. The fossettes are extremely narrow. This is not due wholly to age, for those of older horses are wider. As a result of this narrowness the areas representing the other elements of the teeth are broader than usual. The protocones are unusually long and they are thin from side to side. Their lengths are given among the measurements of the upper teeth. In some cases the anterior end comes into contact with the enamel of the next tooth in front. The post-protoconal valley is directed strongly forward; and it lacks much of attaining the center of the crown. In each premolar there is an indication of a reentrant fold near the head of the valley, but none in the molars. Probably at an earlier stage of wear this fold was deeper, but in the premolars of a much older domestic horse the valley has the fold very distinct.

The enamel surrounding the fossettes is extremely simple (pl. 57, figs. 2, 3); but here again it is necessary to make some, but not too much, allowance for age. Even the very old domestic horse referred to has the enamel more plicated.

As shown in a table given above, the lower teeth (pl. 58, fig. 2) likewise are unusually broad. The outer valley does not in any of

¹ Bull. Amer. Mus. Nat. Hist., vol. 14, p. 98.

the teeth push itself in between the longitudinally directed portions of the valleys entering from the inner side of the tooth. On the inner side of the tooth the groove between the metaconid and the metastylid is very deep and it is angular at its inner end. The longitudinal expansion of the hinder of the two inner valleys of the molars and last premolar is directed obliquely to the long axis of the tooth.

In the same mining claim, and apparently at the same depth, Mr. Morrison found the right ramus of the lower jaw of another horse. The ascending portion is missing. All the cheek teeth are present, a large canine, and five of the incisors. The teeth show that the animal was a male about 5 years old. The catalogue number in the U. S. National Museum is 8427.

That portion of the jaw which is preserved resembles considerably that of *E. lambei* in form and dimensions. It differs from the latter and from all other equine jaws examined in having on the outer face a strongly developed ridge, which, beginning at pm₂, runs downward and backward, reaching the lower border below the penultimate molar. The thickness of the jaw at the last premolar is 34 mm.

The length of the premolar-molar series is 172 mm.; of the premolar series, 90 mm.; of the molar series, 83 mm.

* *Measurements of lower teeth in millimeters.*

Teeth.	Height.	Length.	Width.	Index.
Pm ₂	35.0	16.2	46.3
Pm ₃	60	27.8	17.8	64.0
Pm ₄	75	28.2	19.5	69.2
M ₁	60	26.5	17.0	64.2
M ₂	69	26.0	16.0	61.5
M ₃	69	30.0	16.0	53.3

A comparison of these measurements and indices with those obtained from the lower jaw of the type of *E. lambei* shows that the two sets of teeth agree in many respects. The differences might be attributed to different stages of wear. It is not, however, certain that the relations of length and width vary greatly with the stages of wear in the lower teeth.

When the structure of the teeth of the jaws of the two horses is compared there appear various differences which seem to be important. The groove between the metaconid and the metastylid is not so deep and angular in the odd jaw as it is in the type of *E. lambei*. In the third and fourth premolars of the odd jaw the longitudinal portions of the anterior valley is broader and has a shallow infolding of the enamel which does not appear in the other jaw. In the molars the longitudinal portion of the hinder valley is not

obliquely directed forward and outward, as in *E. lambei*, but has its anterior end turned inward so strongly that the metastylid is nearly cut off from the metaconid. The hinder end of the loop is likewise turned more or less outward.

The outer incisor tooth of the jaw here described appears to have been quite different from that of the type of *E. lambei*. Although this incisor in the type is worn until the bottom of the cup has passed, there are yet indications of its former presence. In this incisor of the odd jaw the cup is replaced by a broad groove on the hinder face of the crown.

It is believed that this odd jaw belongs to a species distinct from the type *E. lambei*, but it is perhaps better to await further discoveries before giving it a name.

In any studies of the animals found in Alaska and Yukon it is important that we consider carefully the related species which are found in northeastern Asia.

In 1893¹ J. Tscherski described a well-preserved skull of a horse which had been obtained at Liakhof Island, in the Arctic Ocean. This skull he referred to *Equus caballus*. Many measurements taken from this skull are given on pages 333 and 334 of Tscherski's paper. The basilar length was 502 mm.; the facial width, 216 mm.; the distance from the rear of the orbit to the incisive border, 381.5 mm.; the width of the face at the maxillo-malar suture (width of cheeks), 191 mm.; the length of the upper tooth line, 175 mm.

The cephalic index of this skull is therefore 43. The facial length may be estimated from the right angled triangle formed by the half of the frontal width and the distance from the incisive border to the rear of the orbit. It is 365.8 mm. The facio-cephalic index is therefore 72.6. On account of injury done to the occipital crest the vertex length and the cranial length could not be obtained. Hence the cranio-cephalic index can not be determined. The index of the tooth line (molar-premolar length \times 100 \div basilar length) is 34.9. If these fundamental measurements and the indices of this Siberian skull and that from Yukon are brought together they may be easily compared.

Table of measurements and indices.

Horse.	Basilar length.	Frontal width.	Cephalic index.	Facial length.	Facio-cephalic index.	Tooth line.	Tooth index.
Yukon.....	446	198	44.4	343	76.9	167	35.2
Siberian.....	502	216	43	365.8	72.7	175	34.9

¹ Mem. Acad. Sci. St. Petersburg., vol. 40, p. 335, pl. 5; pl. 6, fig. 5.

It will be seen that the Yukon horse is quite distinct from the one described by Tscherski. It is smaller, and had a head somewhat broader relatively to the length, and a considerably longer face. The teeth of the Siberian horse are relatively broad and the protocone approaches in width that of *E. lambei*; but in many important features the teeth are quite different.

A careful examination of Tscherski's figure 4 of his plate 5 shows that the part of the maxilla behind the infraorbital foramen in the Siberian horse was not swollen as it is in the Yukon species; but was, rather, considerably excavated.

EXPLANATION OF PLATES.

PLATE 56.

Equus lambei. Type.

- FIG. 1. View of left side of skull. $\times .318$.
2. View of lower premolars and molars. $\times 1$.

PLATE 57.

Equus lambei. Type.

- FIG. 1. View of lower surface of skull. $\times .33$.
2. View of grinding faces of premolars. $\times 1$.
3. View of grinding faces of molars. $\times 1$.

PLATE 58.

Equus lambei. Type.

- FIG. 1. View of upper surface of skull. $\times \frac{1}{3}$.
2. View of grinding faces of lower premolars and molars. $\times 1$.